

Interventions for Detrusor Overactivity: The Case for Multimodal Therapy

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Viable therapeutic alternatives for the management of overactive bladder (OAB) have recently evolved that provide satisfactory symptomatic control for the majority of patients. However, the presupposition that interventions exist as stand-alone entities is not representative of experience in unique populations with the therapeutic benefit of combination therapy, using components drawn from behavioral, physiotherapeutic, neuromodulatory, and, if necessary, surgical alternatives. Even in populations relatively refractory to therapy, the use of multimodal therapy yields additive benefits for patients with OAB symptoms. Herein is detailed the evidence supporting the concept that multimodal therapy provides optimal benefit to patients suffering from this symptom complex.
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Multiple interventions have proven efficacious in treatment for the symptoms of overactive bladder (OAB). Combination therapy is crucial to obtain optimal results for the patient with incontinence. Therapy may include any combination of the following: fluid restriction, timed voiding or prompted voiding, pharmacotherapy, and formal pelvic floor physiotherapy (biofeedback, electrical stimulation, neuromodulation). The role of each therapeutic constituent will vary for specific individuals, and any unique individual may need the addition of, or conversion to, alternative therapies depending on response to the initial interventions.

Recent pharmacologic advances have supplied the practitioner with formulations of medications that have improved bioavailability and therapeutic indices compared to older agents. The recognition of the roles of different metabolic pathways and drug metabolite effects (both therapeutic and toxic) has also allowed alterations in drug delivery so as to achieve relatively stable serum levels and similar bioavailability in the young and the elderly.

found that of 31 women (with a mean age of 41), 87% were subjectively improved or cured after therapy, with a 60% objective cure rate.² In a 5-year follow-up study of these patients, Cardozo and Stanton found that only four of the 11 originally cured or improved patients remained so.³

In older, community-dwelling female populations, biofeedback as a component of pelvic floor therapy has been demonstrated to have benefit as a solitary intervention. In a random-

greater than 50% in incontinence magnitude in both the biofeedback and the physiotherapy groups than in the control group.

At completion of the 8-week course of pelvic floor therapy, 23% and 16% of the biofeedback and the pelvic muscle exercise patient groups, respectively, demonstrated complete resolution of their symptoms, with biofeedback also producing a greater overall reduction in incontinence episodes (61%) than pelvic muscle exercises (54%) or no intervention (6%). These efficacy rates were noted to remain stable with time for the moderate group; however, a surprisingly substantial number of patients recorded continued statistically significant improvement at 6 months compared to immediate post-intervention incontinence rates. Interestingly, the minimally affected group actually worsened with chronic follow-up, perhaps attributable to lack of subject motivation to pursue chronic therapy for a problem that was less personally significant. Substantial changes in electromyographic activity of the pelvic floor and improvement in urethral impedance measures correlated with these findings.

In evaluating the effect of combined behavioral therapy and physiotherapy, Wyman and colleagues combined behavioral therapy with pelvic muscle exercise and formal biofeedback in a

The minimally affected group actually worsened with chronic follow-up.

Advancements in technique have made neuromodulation a viable intervention for patients with refractory detrusor overactivity. Several different methods of neuromodulation have yielded substantive benefit for those patients. Open surgical intervention remains the therapy of last resort; however, newer techniques for bladder augmentation may provide less morbid yet efficacious alternatives for individuals with refractory OAB symptoms.

The Basis: Behavioral and Physiotherapeutic Interventions

The roles of individual therapies for OAB have been evaluated in several studies. When they compared behavioral therapy to biofeedback, both used as isolated interventions, Burton and colleagues demonstrated that each had essentially the same magnitude of effect in incontinence episode reductions (82% vs 79%) from baseline. All patients experienced some degree of improvement, and the effect was noted within 1 month of beginning therapy. The majority of the patients (20 of 27) had urge-predominant symptoms.¹ Cardozo and coworkers also evaluated biofeedback as an independent intervention and

ized evaluation of 135 women with incontinence, three separate interventions were evaluated: pelvic muscle exercises, biofeedback, and control (no intervention).⁴ The primary efficacy variable was self-reported incontinence episodes, evaluated to baseline, during 8 weeks of active therapy, at 2 weeks following completion of active therapy, and 3 and 6 months. Prompting was used after therapy to promote continued compliance. Secondary outcome measures included pelvic floor electromyographic recording and urodynamic assessment of urethral closure pressures.

Both active therapies produced significant changes by 3 weeks of active treatment. Women with mod-

When comprehensive behavioral strategies are used in conjunction, significant reductions in weekly incontinence episodes occur.

erate to severe urinary loss (defined by number and severity of episodes) showed continued improvement throughout active therapy, whereas women with incontinence of minimal magnitude showed no such time-related improvement. Significantly, more women attained a reduction

randomized trial and compared them to either isolated behavioral therapy or only biofeedback. In this superbly designed study, which evaluated various interventions and the effects of crossover on treatment outcome, 59 women with detrusor instability were evaluated; the combination-

treated patients had significantly fewer episodes of incontinence, better quality of life, and higher treatment satisfaction than either of the groups receiving isolated therapy. These differences were maintained over a 3-month follow-up duration.⁵

Burgio and coworkers combined behavioral treatments with biofeedback and noted large reductions in urge urinary incontinence (UI) in patients with and without urodynamic evidence of detrusor motor instability. A mean 85% improve-

ment in 12 patients with motor instability (range 39%–100%) and a mean 94% improvement in 8 patients without motor instability (range 83%–100%) were noted. These authors stressed a home training component as essential to therapeutic success.⁶

The cumulative evidence suggests an added advantage of intensive physiotherapy (biofeedback) over pelvic floor exercises only, especially when evaluating patients more bothered by UI (ie, those with more significant degrees of incontinence).

Clearly, substantive data exist to support the use of multimodal therapy using pelvic floor physiotherapy. Such therapy has significant benefit for cognitively intact elderly patients with severe incontinence. When comprehensive behavioral strategies including pelvic floor exercises, prompted voiding, biofeedback, and other behavioral modifications are used in conjunction, significant reductions in weekly incontinence episodes occur. With this approach, McDowell and colleagues reported

Integrating Biofeedback Into a Urology Practice

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Biofeedback and pelvic floor exercises (PFEs) can be used as a primary treatment for overactive bladder (OAB). Biofeedback appears to alter the facilitatory and inhibitory balance in the central nervous system to modify the complex events that result in the perception of the sensation of urinary urge. Thus the urge to void is inhibited or not perceived as often. A biofeedback program can be successfully integrated into urologic practice, providing there is an understanding of its use and indications as well as a commitment to providing high-quality service.

How do biofeedback and PFEs work to treat OAB?

Although the mechanism of action has not been completely elucidated, voluntary contraction of the external sphincteric mechanism and the pelvic floor results in reflex inhibition of the bladder. In addition, biofeedback therapy somehow seems to result in better central nervous system voluntary control of the bladder by the patient.

When should biofeedback be instituted for the treatment of OAB?

Biofeedback may be used as a first-line treatment for OAB. It may be used in patients who do not wish to use medications, or in those who have side effects or an inadequate response to medication. Also, it may be used in combination with pharmacotherapy. Several recent studies have suggested that combination therapy leads to superior results over each individual modality.

Who is biofeedback appropriate for?

The most important aspect of patient selection is a motivated patient. He/she must be capable of learning and eventually performing PFEs independently. The patient must be able to understand and follow directions. The patient must also realize that he/she is making a commitment to long-term therapy.

What equipment and staff are necessary for a successful biofeedback program?

Implementing a biofeedback therapy program requires careful attention to the patient care processes in an office. These processes are essential for the success of a program.

The Clinician: The first step in a successful biofeedback laboratory is the personal involvement by the clinician, who accepts responsibility for the outcome of treatment from the program. That physician must learn everything about biofeedback, develop a clinical program that is integrated with the practice, and ensure that the program is excellent in every aspect.

Biofeedback Therapist: This individual, usually a nurse or physical therapist, must have a personality suitable for behavioral therapy as well as a complete understanding of the neurophysiology of voiding and the concepts of operant conditioning.

Comfortable Environment: Because biofeedback is a behavioral therapy, any distractions or stressful circumstances in the area of the biofeedback laboratory can compromise the treatment outcomes of the program. If the patient is distracted by noise outside the biofeedback laboratory, learning will not occur. Behavioral therapy is very sensitive to anything that prevents behavioral modification of physiological responses. Ideally there should be space dedicated to biofeedback.

Equipment: Usually, the best equipment is not the most expensive. When evaluating equipment, one must be sure that it provides a visual display of performance that accurately shows physiological activity of the response that is to be learned. This is usually the electromyographic activity of the external anal sphincter muscles. If the equipment does not accurately present physiological activity to the patient, learning will not occur.

Table 1
New Agents for Treatment of the Overactive Bladder

Agent	Benefit/Role
Tolterodine tartrate, long-acting (Detrol LA®) (extended-release oral)	Improved tolerability profile, less reduction in saliva production, and improved efficacy compared to immediate-release tolterodine.
Oxybutynin chloride (Ditropan XL®) (extended-release oral)	Predictable bioavailability in all patients, better tolerability than immediate-release oxybutynin
Oxybutynin chloride patch (Oxytrol®) (topical delivery)	Patch delivery mimics stable plasma levels seen with extended-release oral formulations; twice-weekly application
S-Oxybutynin (oral)	Improved tolerability compared to parent drug
Darifenacin (oral)	Improved tolerability compared to immediate-release oxybutynin chloride; highly selective for bladder muscarinic receptors

an average 81.6% reduction in diary-reported episodes, with mean reductions of incontinent episodes from 16.9 at baseline to 2.5 at study end ($P < .01$) in a group of 70 cognitively intact patients from 56 to 90 years of age.⁷ The only stratifier for outcome was failure of prior therapy, which was predictive of failure of this method.

Combining behavioral modification and biofeedback has also been shown to have excellent effects on sensory urgency. Millard and Oldenberg showed that 92% of 12 women with sensory urgency benefited from combined treatment. They also reported a 74% improvement rate for 38 women with motor detrusor instability in the same study.⁸ In a fascinating analysis of patient factors predictive of response to pelvic floor therapy as administered with biofeedback and vaginal electrical stimulation, Susset and coworkers attempted to identify those patients who would most benefit from these interventions. Of the 64 patients in the trial, seven had pure urge incontinence and 37 had mixed urge and

stress symptoms. Patients received both interventions, and an overall success rate of 64% (cured and improved) was attained. Younger patients who were compliant with therapy, had no urodynamic evidence of detrusor muscle instability (possibly indicating a less affected group), and had an adequate vaginal estrogen effect did best as compared to those patients who did not have these attributes.⁹

For further information on biofeedback, see the Sidebar, "Integrating Biofeedback Into a Urology Practice" by Dr. Pat O'Donnell.

Pharmacotherapy

The use of pharmacologic delivery systems has provided a glimpse of the beneficial effects on medication bioavailability and therapeutic indices associated with delivery systems that provide alternative access to absorptive and metabolic pathways (Table 1). Studies using tolterodine tartrate demonstrate significant reductions in frequency compared to placebo. Overall mean reductions in inconti-

nence episodes from baseline levels range from 43% to 56%.¹⁰ A sustained-release formulation of tolterodine tartrate (Detrol LA®), which uses a beaded delivery system for sustained drug release over 24 hours, yields sustained 56% mean and 71% median reductions in incontinence episodes.¹¹ The tolerability of the drug has also been enhanced, with significant reductions in dry mouth compared to the immediate-release formulation.

Another type of delivery system which provides single dosing every 24 hours is the oral osmotic system (OROS®). With this delivery system for oxybutynin chloride (Ditropan XL®), associated reductions in incontinence (mean 84.4%, range 79.5%–89.5%) and total continence rates (45.9%) represent a substantive stride over those seen with immediate-release oxybutynin chloride (70.7% improved and 35.6% continent).^{12,13} Improved bioavailability, with resultant enhanced efficacy and tolerability of parent compounds, has been achieved with these alterations in delivery of the drug.

Interestingly, again noted is a strong placebo effect in these trials, with up to 40% reductions in frequency and urge UI episodes. These results have been attributed to patient self-perception changes induced by diary recording, which is inherent to all these trials, supplemented by subtle behavioral influences that emanate from participation in the varying trials.

Several newer and more selective agents are either in trials or soon to be released. Recent experience with a skin patch delivery system (Oxytrol®, Watson Pharmaceuticals, New Jersey) reveals efficacy and substantially improved tolerability profiles compared to other anticholinergic formulations. The patch is applied twice per week, promoting greater compliance.

Further improvements in receptor

activity have been identified with the use of isomeric oxybutynin (Sepracor Pharmaceuticals, Marlborough, MA) and darifenacin (Pfizer Inc., New York, NY). The S-isomer of oxybutynin has been shown to have fewer associated tolerability issues than its isomeric parent; clinical trials are ongoing. Darifenacin is highly selective for the M₃ receptor (the muscarinic receptor responsible for bladder contraction) and has also shown a better tolerability profile than older agents such as oxybutynin chloride. Finally, a newer, perhaps better-tolerated

incontinent episode per 24-hour segment or less) was considered, 25 (40%) of patients on active drug met it, whereas only 11 (18%) patients on placebo did ($P = .005$). The investigators concluded that pharmacotherapy did provide additional benefit when combined with isolated behavioral modification techniques.¹⁴

Recently, the role of individual behavioral or pelvic floor therapies has been compared to that of pharmacologic intervention. Burgio and colleagues evaluated pelvic floor therapy as compared to oxybutynin

evaluated (mean age 69.3 years). This well-designed study underscored the complementary nature of disparate interventions. Single-mode behavioral therapy produced a 57.5% reduction in incontinence episodes (based on diary reporting), but addition of anticholinergic ingestion (oxybutynin chloride 2.5 mg titrated on the basis of efficacy and tolerability to 5 mg three times a day) yielded an incremental response, improving urge incontinence reduction to 88.5% ($P = .034$). Similarly, isolated drug therapy produced a 72.7% reduction, which increased to an 84.3% change after the addition of simultaneous pelvic floor therapy.¹⁶

So the data would appear to support the utility of a combination of modalities inclusive (if possible) of behavioral therapy, active pelvic floor interventions, and pharmacotherapy as obtaining the best results in patients of any age with bladder dysfunction manifested by urgency, frequency, and urge incontinence. This generalization certainly seems to apply to the cognitively intact or minimally impaired, motivated older patient.¹⁷

Neuromodulation

Neuromodulation encompasses a variety of therapies that as a group down-regulate the sacral reflex arc, which governs voiding. All attempts to enhance bladder storage, improving total bladder capacity and decreasing urge UI and urinary frequency. The mechanism of action of neuromodulation appears to be afferent pathway stimulation or regulation. Fowler and coworkers have shown that with afferent stimulation of the pelvic reflex arc, a strong reflex inhibition of detrusor contraction occurs in both healthy and neurologically impaired patients. They have concluded that this effect occurs on a polysynaptic basis (ie, mediated via

Recent experience with a skin patch delivery system reveals efficacy and substantially improved tolerability profiles.

quaternary amine, trospium chloride (Maduas Pharmaceuticals, Germany) has entered clinical trials in the United States. This agent may provide a substantive level of efficacy with very little, if any, central nervous system side effects.

The value of adding pharmacotherapy to isolated prompted voiding (as a variant behavioral modification) has been recently evaluated in selected elderly nursing home residents. In a randomized, placebo-controlled crossover trial, seven nursing home residents with urge UI underwent a trial of prompted voiding with the addition of placebo or oxybutynin. The main outcome measure was number of incontinence episodes. When considering the entire group of patients, the reduction in incontinence was not clinically meaningful, as only a 3% difference was noted between active and placebo groups. Twenty (32%) of the patients on the active drug achieved more than a 30% reduction in incontinence episodes, whereas only 12 (19%) on placebo achieved this goal ($P = .48$). When a criterion of continence (one

chloride and placebo for urge incontinence. In their randomized study, 197 women over age 55 were evaluated prospectively, with the primary endpoints of reduction in UI episodes (by diary recording) and patient approbation of therapy and perception of improvement. Behavioral therapy resulted in an 80.7% reduction (30% complete cure) in incontinence episodes, making it significantly more beneficial than oxybutynin (68.5% reduction, 23% complete cure) or placebo (39.4 % reduction). For all interventions, the greatest rate of change occurred very early in the study, with a slower rate thereafter. Patient perception of improvement was also greatest in the behavioral group (74%); the rate in the drug group was 50.9% and that in the placebo group 26.9%.¹⁵

In an effort to further evaluate the possibility of further benefit obtained from combined therapy, Burgio and coworkers examined yet another population of community-dwelling older women. Using a randomized controlled trial with a modified crossover design, 35 women were

the sacral spinal cord).¹⁸

Neuromodulation was initially pioneered using peripheral anogenital electrical stimulation. Using these techniques (with pulse duration ranging from 0.2 to 1 ms and optimal frequency ranging from 5 to 50 Hz), some authors have achieved outstanding results, approaching 80% improvement rates for urge incontinence, with sustained duration.¹⁹

The paradigm for surgical intervention has also been altered by the increasing use and success of neuromodulation.

Transcutaneous electrical nerve stimulation may be applied either over the sacral foramina (S2 and S3) or at other sites, including over the common peroneal nerve or the posterior tibial nerve. Results have been variable dependent on the site of stimulation, but 76% reductions in frequency and more than 50% reductions in urge incontinent episodes in 69% of treated patients are obtainable with cutaneous sacral stimulation.^{20,21} Stoller has reported a sustained clinical response rate of 81% in 90 patients over a follow-up period of more than 5 years using chronic stimulation of the common peroneal nerve, with no significant risks.²²

Sacral nerve stimulation represents the state of the art for neuromodulation at this juncture. Continuous, direct stimulation of the S3 nerve root provides immediate and long-term benefit for the majority of otherwise refractory patients. Permanent intervention depends upon success of a test period, which heretofore has been percutaneous; recently, incisional test stimulation has demonstrated improved overall results as compared to the percutaneous method. Because of varying techniques, success with this method has varied from 30% to 70%.²³ With the newly U.S. Food and

Drug Administration-approved, two-stage implant, reproducible success rates of 50% to 70% with test stimulation are obtainable.²⁴

Trials have provided definitive evidence of the value of neuromodulation, incorporating a control comparator group. Implantable neuromodulation devices reproducibly provide benefit, with approximately 50% of patients obtaining 90% or

greater improvement in urinary frequency and urge incontinence and an additional 25% obtaining greater than 50% improvement (some patients remained on other therapy, including pharmacotherapy and intensive behavioral modification).²⁵ These results were significantly different from those in patients who served as controls and received an implant 6 months later (in a modified crossover design). These results are relatively well sustained over long-term follow-up. Of 45 patients followed for a mean of 47 months, success rates (with success defined as cure of incontinence) decreased to approximately 65% at 1.5 years but there-

placement has been circumvented by upper buttock placement of the device.²⁶

Surgical Therapy for Refractory Detrusor Over-Activity

Open surgical intervention for refractory detrusor instability presupposes failure of the previous techniques, alone or in combination. The paradigm for surgical intervention has also been altered by the increasing use and success of neuromodulation as a viable alternative for the patient who is unresponsive to the other less invasive therapies.

The use of surgical alternatives also no longer assumes that the patient has refractory motor instability (as diagnosed by urodynamics). Many experts now utilize surgical alternatives for patients with refractory urgency and frequency without a requisite motor component. Even so, it would appear that the overall number of surgical procedures being carried out for refractory bladder overactivity (if neuromodulation is considered as a separate category) has decreased over the last 3–5 years. The goals of surgical therapy are preservation of the upper urinary tracts, prevention of infection, and improvement in symptoms (if not complete continence). Numerous

Open surgical intervention for refractory detrusor instability presupposes failure of the previous techniques.

after remained constant at 5 years' duration. When the device is acutely deactivated, symptoms return to baseline within a matter of days, implying that there is a benefit of chronic stimulation. Complications from therapy arise mainly from lead migration or malpositioning, which occurs in approximately 20% of patients. Pain from generator site

surgical interventions have been described for bladder overactivity, including cystoscopic and open surgical procedures, such as bowel augmentation, autoaugmentation, or denervating procedures; however, long-term follow-up for many of these interventions is lacking.

Cystoscopic hydrodistention of the bladder is often used as a therapeutic

intervention for nonspecific bladder disorders such as interstitial cystitis but is also used as a first intervention for refractory urinary urgency and frequency. Hydrodistention may actually produce an affect on unmyelinated C-afferent fibers in the bladder, producing local deafferentation and thus ameliorating symptoms. Success rates have been reported to approach 77%; however, less substantial results are usually encountered. Complications include transient hematuria, infection, and a risk of bladder perforation of up to 10%.²⁷

Open surgical interventions include those directed at the peripheral nerves involved in the sacral reflex arc or at the base of the bladder. Chemical or surgical ablation of local sensory and motor radicals has been performed. Chemical neuroablation uses either absolute alcohol or dilute phenol (6%) injected at the bladder base. Success rates of 100% at 1.5 years have been described, but severe complications such as vesicovaginal fistulas can occur with this intervention.²⁸

Surgical ablation of the same local neural paths has also been used for symptom control in patients with refractory detrusor instability.²⁹ McGuire initially reported a 70% cure of motor instability using a vaginal technique with disruption of the terminal postganglionic parasympathetic fibers. Recent experience using a modified Ingelman-Sundberg approach (transient block with short-acting local anesthesia followed by formal ablation in responders to the test block) has provided cure (resolution of symptoms) in 64% of patients (16) at a mean of 14.8 months after surgery.³⁰

Initial attempts at control of detrusor overactivity centered on complete denervation of the bladder with a procedure known as *cystolysis*. However, this procedure, despite acceptable early results, was found to result in a defunctionalized bladder,

with poor compliance and low storage volumes, and success rates at more than 1 year of 16%.³¹ Subsequently, selective neural rhizotomy was evaluated, with either an intra- or an extradural approach to the sacral 2–5 nerve root. Although complete rhizotomy is very effective for ablating detrusor contraction, collateral defunctionalization of the external urethra, as well as ablation of erectile function in males and sexual response in females, limits the applicability and reasonability of this approach. Rhizotomy combined with

larization is the key factor in success, as nondetubularized bowel retains contractile capabilities and may function as a contractile diverticulum when anastomosed to the bladder. Minimal data exist for this intervention in patients with nonneurogenic incontinence. However, recent experience suggests that well-performed augmentation still provides a successful option, especially for neurogenic patients. Herschorn and Hewitt, in their well-done long-term review of augmentations, which included well-documented safety and efficacy data,

Rhizotomy combined with anterior root (S2–4) motor stimulation using a fully implantable system has been reported to provide marked improvement over nonselective rhizotomy.

anterior root (S2–4) motor stimulation using a fully implantable system has been reported to provide marked improvement over nonselective rhizotomy.³² A recent evaluation of this approach in 90 patients demonstrated that 83 were able to void spontaneously and 82 were continent, with substantial improvements in bladder capacity and compliance.³³ Two patients required device explantation for infection and three developed problematic cerebrospinal fluid leaks. This system has proven to be robust and to provide substantial cost savings.³⁴

Augmentation enterocystoplasty has served as the mainstay of surgical intervention for the past several decades. The interposition of a bowel segment has been shown to interrupt detrusor contractions, creating a stable reservoir with low storage pressures and preservation of the upper urinary tracts. Both the optimal bowel segment and the configuration of that segment for augmentation have been matters of debate for years, although evidence now suggests that detubu-

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reported 59 neurogenic incontinence patients who, after augmentation, developed complete continence (67%), improved bladder capacity (mean 523 mL, increased from 220 mL), improved compliance (terminal storage pressures of 15.8 cm H₂O, decreased from 48 cm H₂O) and substantial patient satisfaction with the results of the procedure.³⁵ The most serious complication of augmentation is perforation, which is thought to be an ischemic phenomenon and occurs in 2%–6% of patients. Surgical revision rates approach 30% for complications arising from augmentation enterocystoplasty, which include recurrent infection, metabolic abnormalities, and urinary or intestinal leaks.^{35,36} Options for the augmentation segment include sigmoid colon, cecum, small intestine, and stomach. The best segment to use depends on the individual patient's anatomy, the surgeon's experience, and regional pelvic anatomic and pathologic considerations.

Three relatively recent options have arisen for the surgical manage-

ment of refractory bladder overactivity. Selective removal of large amounts of detrusor muscle, leaving only bladder mucosa to form a pseudodiverticulum, has been reported as having short-term results comparable to those of formal augmentation. Detrusor myomectomy, also known as autoaugmentation, has been

replacement is that of using defunctionalized ureter (either due to renal nonfunction or prior nephrectomy without ureterectomy) as a full-thickness interpositional tissue for augmentation. This technique has been used extensively in children. Churchill performed autoaugmentation in 16 children, with minimal

tion, should be reserved for those in whom the first-line interventions fail. However, improved surgical experience with both neuromodulation and bladder augmentation provides more reasonable surgical alternatives in comparison with prior methods. ■

The possible interventions for bladder overactivity have increased substantially in number over the last decade.

reported to have success (cure of incontinence) rates approximating 80%.³⁷ Long-term follow-up is lacking, and concern regarding muscle regeneration or serosal fibrosis causing adverse effects on bladder capacity and compliance will need to be addressed. Another surgical option is that of demucosalized detubularized intestine (seromuscular enterocystoplasty) as an inlay over the exposed detrusor mucosa after excision of the detrusor musculature. The benefits of this procedure as compared to simple myomectomy include prevention of mural fibrosis and also of bladder smooth muscle reapproximation by bridging of the defect created by the smooth muscle excision. Long-term results are still not available, but short-term efficacy and complications are very acceptable, according to studies including a comparative study of standard augments as compared to a newer, less invasive technique.^{38,39} A novel approach to bladder

complications.⁴⁰ Fifteen required postoperative catheterization; however, substantial improvements in capacity and compliance were noted.

Urinary diversion remains a method of last resort, used only for those patients in whom all prior interventions have failed. With the advent of neuromodulation, this option is less used solely for the indication of refractory urgency and urge UI.

Conclusion

The possible interventions for bladder overactivity manifested by urgency, frequency, and urge UI have increased substantially in number over the last decade. Explicit evidence, in aggregate, implies a cumulative benefit from multimodal therapy that maximizes behavioral and pelvic floor interventions, with the adjunct of pharmacologic intervention. More intensive therapies, including neuromodulation and surgical interven-

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Main Points

- The substantial symptomatic benefit observed for overactive bladder (OAB) with behavioral modification only mandates placebo-controlled comparisons for any new intervention to determine its unique benefit.
- Individual therapeutic interventions for bladder overactivity provide unique efficacy benefit.
- Combination use of unique therapies provides sustained additional benefit over the individual interventions.
- Therapeutic options for OAB continue to evolve, with the development of better forms of neuromodulation and surgical intervention.

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